

Devices and Methods for Collection and Concentration of Air and Surface Samples for Improved Detection of Microbes onboard ISS, Phase I Project

SBIR/STTR Programs | Space Technology Mission Directorate (STMD)



ABSTRACT

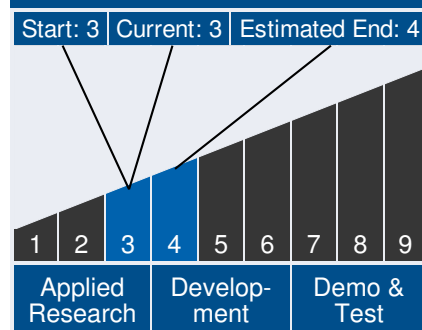
Protecting the International Space Station (ISS) crew from microbial contaminants is of great importance. Bacterial and fungal contamination of air, surfaces and water aboard ISS has the potential to cause sickness among ISS crew and to impact onboard experiments. Further, it has been noted that pathogenicity and virulence of microbes can increase in microgravity environments. These factors, along with the high consequence of sickness in the remote space environment, creates a significant need for a rapid way to determine when microbial contamination events occur. To this end, InnovaPrep LLC of Drexel, MO proposes development of improved methods for collection of microbes from air and surfaces for delivery into a small liquid volume compatible with advanced molecular based detection systems. Rapid microbiological detection systems have taken dramatic steps forward in the last two decades and today detection of even a single organism is possible in less than one hour. Unfortunately, development of rapid detection methods has far outpaced development of sample collection and concentration techniques, which are necessary to enable detection of low microbial concentrations in the environment. In the proposed Phase I work, InnovaPrep will leverage current aerosol and surface collection and elution technologies and innovations from a 2015 NASA awarded SBIR for microbial concentration from ISS potable water, for handling of these technologies in a microgravity environment, to develop novel ISS aerosol and surface collection systems. Specifically, InnovaPrep will develop new, optimized aerosol filter assemblies and surface sampling assemblies that allow for collection from larger air volumes and surface areas and elution into smaller liquid volumes than is currently possible.



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Technology Maturity



Management Team

Program Executives:

- Joseph Grant
- Laguduva Kubendran

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ANTICIPATED BENEFITS

To NASA funded missions:

Potential NASA Commercial Applications: Protecting the ISS crew from microbial contaminants is of great importance. Bacterial and fungal contamination of air, surfaces and water aboard ISS has the potential to cause sickness among ISS crew and to impact onboard experiments. Further, as noted by Yamaguchi et al., crewed habitats in space can significantly alter the relationships between humans and microbes, including increasing the pathogenicity and virulence of microbes. The possible high penalty of sickness while aboard the ISS creates a significant need for a rapid way to determine when microbial contamination events occur. To this end, InnovaPrep proposes development of improved methods for collection of microbes from air and surfaces for delivery into a small liquid volume compatible with advanced molecular based detection systems. In 2015, InnovaPrep was awarded a Phase I SBIR for development of a microbial concentration system for ISS potable water and, after what by most measures was a successful Phase I project, is currently awaiting word on a potential Phase II award. This system is based on membrane filtration of water samples and Wet Foam Elution of the captured particles. This method was developed by InnovaPrep as a means for efficiently eluting microbial particles from large membrane filters and quickly led InnovaPrep to apply this technique to elution of microbes from aerosol collection filters and swabs, wipes and other surface sampling instruments with significant success.

To the commercial space industry:

Potential Non-NASA Commercial Applications: InnovaPrep has applied this wet foam elution technique to elution of microbes from aerosol collection filters and swabs, wipes and other surface sampling instruments with significant success. Specifically, with regard to aerosol collection, the company has developed a family of aerosol collectors that utilize electret filter

Management Team (cont.)

Program Manager:

- Carlos Torrez

Principal Investigator:

- Andrew Page

Technology Areas

Primary Technology Area:

Human Health, Life Support, and Habitation Systems (TA 6)

- └ Environmental Monitoring, Safety, and Emergency Response (TA 6.4)
 - └ Sensors: Air, Water, Microbial, and Acoustic (TA 6.4.1)

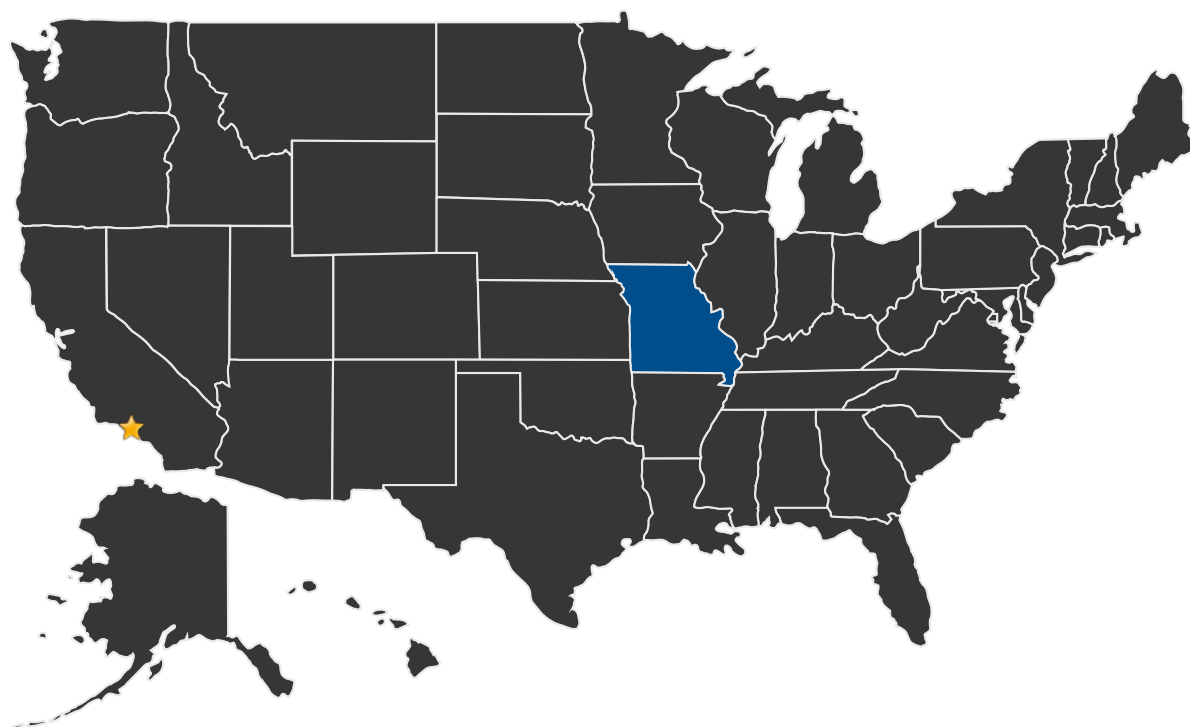
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collection and wet foam elution, called the Bobcat, has quickly become the go to collector for ongoing Department of Defense (DoD) biodefense detection programs. An integratable version of the Bobcat is the selected collector for the DoD Joint Biological Tactical Detection System program and is also being used in several configurations by three of the large scale integrators on the ongoing DoD Joint United States Forces Korea Portal and Integrated Threat Recognition (JUPITR) program. Further, the underlying technology was also recently selected for award under the Department of Homeland Security SenseNet program as part of a team selected to develop an autonomously operated bioterrorism detection system. InnovaPrep is also in discussions with multiple commercial partners about the potential of developing a very low cost collector based on these same technologies that would be used for microbial monitoring in the agricultural and pharmaceutical industries. In the area of surface collection, InnovaPrep has more recently engaged in development of a range of surface collection devices for Animal Health, DoD and Food Safety.

U.S. WORK LOCATIONS AND KEY PARTNERS



■ U.S. States With Work

★ **Lead Center:**
Jet Propulsion Laboratory

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Other Organizations Performing Work:

- InnovaPrep, LLC (Drexel, MO)

PROJECT LIBRARY

Presentations

- Briefing Chart
 - (<http://techport.nasa.gov:80/file/23157>)

IMAGE GALLERY



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DETAILS FOR TECHNOLOGY 1

Technology Title

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Potential Applications

Protecting the ISS crew from microbial contaminants is of great importance. Bacterial and fungal contamination of air, surfaces and water aboard ISS has the potential to cause sickness among ISS crew and to impact onboard experiments. Further, as noted by Yamaguchi et al., crewed habitats in space can significantly alter the relationships between humans and microbes, including increasing the pathogenicity and virulence of microbes. The possible high penalty of sickness while aboard the ISS creates a significant need for a rapid way to determine when microbial contamination events occur. To this end, InnovaPrep proposes development of improved methods for collection of microbes from air and surfaces for delivery into a small liquid volume compatible

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